

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strikethrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

1. (currently amended) A distribution route generation apparatus, comprising:
a collection device collecting information about a communications cost between a plurality of nodes of a communications network the nodes including a plurality of redistribution servers which copy and branch streaming data at respective branch points in the communication network to multi-cast the streaming data in an application layer where route cost is based on delay and number of hops, stream rate, reference rate, predetermined value as an additional cost and coefficients used to convert delay to number of hops where route cost = number of hops + α * max (0, (delay- β)) * stream rate / reference rate + predetermined value;

a generation device automatically generating distribution route information, which indicates a plurality of distribution routes to a plurality of clients on the communications network forced to pass through at least one of the redistribution servers from a source, based on the information about the communications cost when the streaming data are originated and distributed from the source to the plurality of clients; and

an output device outputting the distribution route information.

2. (original) The distribution route generation apparatus according to claim 1, wherein said generation device generates the distribution route information by selecting a receiver node in such a way that a communications cost between the source and the receiver node is minimized.

3. (original) The distribution route generation apparatus according to claim 1, wherein said generation device generates the distribution route information by selecting a receiver node in such a way that a communications cost between each node on a distribution route being generated and the receiver node is minimized.

4. (original) The distribution route generation apparatus according to claim 1,

wherein said generation device divides the nodes into a plurality of groups, generates inter-group distribution route information using a group to which the source belongs as an origin, generates intra-group distribution route information in the group to which the source belongs using the source as an origin, and generates intra-group distribution route information in the other groups using a node that is an input branch end of an inter-group distribution route, as an origin.

5. (original) The distribution route generation apparatus according to claim 4, wherein said generation device divides the nodes into the groups using a branch in which a communications cost between nodes is equal to or more than a threshold value, as a boundary.

6. (original) The distribution route generation apparatus according to claim 1, further comprising
a restriction device restricting a measurement range of the communications cost.

7. (original) The distribution route generation apparatus according to claim 6, wherein said restriction device designates a router that is connected to a backbone of the communications network and designates at least one node that is connected to the backbone via the designated router as a measurement target.

8. (original) The distribution route generation apparatus according to claim 6, wherein said restriction device detects a router located within a first restricted number of hops from a measuring node performing measurement, based on information about a route from the source to the measuring node and designates a node located within a second restricted number of hops from the detected router as a measurement target.

9. (original) The distribution route generation apparatus according to claim 1, further comprising
a detection device detecting change in a network situation based on information of at least one of a data packet and a control packet,
wherein said collection device collects the information about the communications cost when the network situation changes.

10. (original) The distribution route generation apparatus according to claim 1, further

comprising

a detection device detecting change in a network situation based on information of at least one of a data packet and a control packet,

wherein said generation device re-generates distribution route information when the network situation changes.

11. (original) The distribution route generation apparatus according to claim 1, wherein said generation device further generates distribution route information indicating a substitute distribution route, excluding a part in which a failure is anticipated to occur on the communications network.

12. (original) The distribution route generation apparatus according to claim 11, further comprising

a detection device detecting change in a network situation based on information of at least one of a data packet and a control packet,

wherein said generation device switches a current distribution route to the substitute distribution route when the network situation changes.

13. (currently amended) A computer-readable storage medium that records a computer program for enabling a computer to perform a process, said process comprising:

collecting information about a communications cost between a plurality of nodes of a communications network the nodes including a plurality of redistribution servers which copy and branch streaming data at respective branch points in the communication network to multi-cast the streaming data in an application layer where route cost is based on delay and number of hops, stream rate, reference rate, predetermined value as an additional cost and coefficients used to convert delay to number of hops where route cost = number of hops + α * max (0, delay - β) * stream rate / reference rate + predetermined value; and

automatically generating distribution route information, which indicates a plurality of distribution routes to a plurality of clients on the communications network forced to pass through at least one of the redistribution servers from a source, based on the information about the communications cost when the streaming data are originated and distributed from the source to the plurality of clients.

14. (cancelled)

15. (currently amended) A distribution route generation method, comprising:
collecting information about a communications cost between a plurality of nodes of a communications network the nodes including a plurality of redistribution servers which copy and branch streaming data at respective branch points in the communication network to multi-cast the streaming data in an application layer where route cost is based on delay and number of hops, stream rate, reference rate, predetermined value as an additional cost and coefficients used to convert delay to number of hops where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value; and
automatically generating distribution route information, which indicates a plurality of distribution routes to a plurality of clients on the communications network forced to pass through at least one of the redistribution servers from a source, based on the information about the communications cost when the streaming data are originated and distributed from the source to the plurality of clients.

16. (original) The distribution route generation method according to claim 15, wherein said distribution route information is distributed from an upper-stream node to a lower-stream node along the distribution routes.

17. (original) The distribution route generation method according to claim 16, wherein information that need not be transmitted to the lower node is deleted from the distribution route information in the upper-stream node and remaining information is distributed from the upper-stream node to the lower-stream node.

18. (original) The distribution route generation method according to claim 16, wherein a port is secured to receive the streaming data in the lower-stream node and identification information of the port is notified from the lower-stream node to the upper-stream node.

19. (previously presented) A distribution route generation apparatus, comprising:
collection means for collecting information about a communications cost between a plurality of nodes of a communications network the nodes including a plurality of redistribution servers which copy and branch streaming data at respective branch points in the communication network to multi-cast the streaming data in an application layer where route cost is based on

delay and number of hops, stream rate, reference rate, predetermined value as an additional cost and coefficients used to convert delay to number of hops where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value;

generation means for automatically generating distribution route information, which indicates a plurality of distribution routes to a plurality of clients on the communications network forced to pass through at least one of the redistribution servers from a source, based on the information about the communications cost when the streaming data are originated and distributed from the source to the plurality of clients; and

output means for outputting the distribution route information.

20. (currently amended) A multicast distribution routing method for multicasting streaming data over a multiply connected node network from a source to multiple destinations, comprising:

determining the connection cost between nodes of the network where route cost is based on delay and number of hops, stream rate, reference rate, predetermined value as an additional cost and coefficients used to convert delay to number of hops where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value; and

determining routes to the multiple destinations from the source responsive to the connection cost where each route is forced to pass through a redistribution server.

21. (currently amended) A multicast distribution routing method for multicasting streaming data over a multiply connected node network from a source to multiple destinations where the network has redistribution servers, comprising:

determining the connection cost between nodes of the network where route cost is based on delay and number of hops, stream rate, reference rate, predetermined value as an additional cost and coefficients used to convert delay to number of hops where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value; and

determining routes through the redistribution servers to the multiple destinations from the source responsive to the connection cost where each route is forced to pass through at least one redistribution server.

22. (currently amended) A multicast distribution method for multicasting streaming data over a multiply connected node network from a source to multiple destinations where the network has redistribution servers, comprising:

determining the connection cost between nodes of the network where route cost is based on delay and number of hops, stream rate, reference rate, predetermined value as an additional cost and coefficients used to convert delay to number of hops where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value;

determining routes through the redistribution servers to the multiple destinations from the source responsive to the connection cost where each route is forced to pass through at least one redistribution server; and

multicasting the streaming data responsive to the routes.

23. (currently amended) A multicast distribution method for multicasting streaming data over a multiply connected node network from a source to multiple destinations where the network has redistribution servers, comprising:

determining the connection cost between nodes of the network where route cost is based on delay and number of hops, stream rate, reference rate, predetermined value as an additional cost and coefficients used to convert delay to number of hops where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value;

determining routes through the redistribution servers to the multiple destinations from the source responsive to the connection cost where each route is forced to pass through at least one redistribution server t_i ; and

multicasting the streaming data responsive to the routes and copying the data for route branches at the redistribution servers.

24. (currently amended) A multicast distribution system for multicasting streaming data, comprising:

a multiply connected node network connecting multiple clients;

redistribution servers located at nodes of the network and copying the data for route branches;

a master server connected to the network, producing the multicasting data, obtaining cost information for connection cost for nodes of the network where route cost is based on delay and number of hops, stream rate, reference rate, predetermined value as an additional cost and coefficients used to convert delay to number of hops where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value, determining routes with the route branches and routing the multicasting data over the network through the redistribution servers to the multiple clients responsive to the cost information where each route is forced to

pass through at least one redistribution server.

25. (canceled)

26. (previously presented) A system as recited in claim 23, wherein the network comprises the Internet.

27. (currently amended) A multicast distribution routing method for multicasting streaming data over a multiply connected node network from a source to multiple destinations, comprising:

determining the connection cost between nodes of the network where route cost is based on delay, stream rate, reference rate and number of hops where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value; and

determining routes to a multiple destinations from the source responsive to the connection cost where each route is forced to pass through at least one redistribution server.

28. (previously presented) A multicast distribution routing method for multicasting streaming data over a multiply connected node network from a source to multiple destinations, comprising:

determining the connection cost between nodes of the network where cost = number of hops + α *max (0, (delay- β))*stream rate/reference rate + predetermined value) and where α and β are coefficients to convert delay to number of hops, stream rate is a speed of a distribution stream, and reference rate is expected stream rate; and

determining routes to the multiple destinations from the source responsive to the connection cost where each route is forced to pass through at least one redistribution server.

29. (previously presented) A method as recited in claim 28, wherein the predetermined value is set by a network manager to restrict flow through a route.

30. (currently amended) A multicast distribution routing method for multicasting streaming data over a multiply connected node network via routes from a source to multiple destinations, comprising:

determining connection costs between nodes of the network where route cost is based on delay, stream rate, reference rate and number of hops and the routes passing through a

redistribution server where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value; and

determining routes to the multiple destinations from the source responsive to the connection costs.

31. (currently amended) A multicast distribution routing method for multicasting streaming data over a multiply connected node network via routes from a source to multiple destinations, comprising:

determining connection costs between nodes of the network where route cost is based on the routes passing through a redistribution server where route cost = number of hops + α * max (0, delay- β) * stream rate / reference rate + predetermined value; and

determining routes to the multiple destinations from the source responsive to the connection costs.

32. (new) A multicast distribution routing method for multicasting streaming data, comprising:

calculating connection costs between nodes of a network where routes pass through a redistribution server and the network comprises a multiply connected network with the routes from a source to multiple destinations and with more than one route from a source to some of the destinations; and

determining transmission routes to the multiple destinations from the source responsive to the connection costs.